

What Is Claimed Is:

1 1. A method of processing a plurality of layer-3 datagrams in a first edge router, said first edge
2 router being connected to a second edge router by a layer-2 network, said method comprising:
3 provisioning in said first edge router a plurality of virtual circuits on said layer-2 network, said
4 plurality of virtual circuits being associated with a layer-3 route;
5 receiving in said first edge router said plurality of layer-3 datagrams;
6 determining in said first edge router a subset of layer-3 datagrams, with each datagram having
7 a corresponding layer-3 route equal to said layer-3 route, wherein said subset of layer-3 datagrams are
8 comprised in said plurality of layer-3 datagrams;
9 encapsulating each of said subset of layer-3 datagrams in a corresponding plurality of layer-2
10 packets, some of said subset of layer-3 datagrams being encapsulated for sending on a first one of said
11 plurality of virtual circuits and some other of said subset of layer-3 datagrams being encapsulated for
12 transmission on another one of said plurality of virtual circuits; and
13 sending said plurality of layer-2 packets related to said subset of layer-3 datagrams on said
14 layer-2 network according to said encapsulating.

1 2. The method of claim 1, wherein said determining comprises using a destination address
2 comprised in each of said layer-3 datagrams to determine said corresponding layer-3 route.

1 3. The method of claim 2, wherein said layer-2 network comprises a plurality of switches
2 providing a plurality of physical paths between said first edge router and said second edge router, said
3 first one of said plurality of virtual circuits being provided on a first one of said plurality of physical paths
4 and said second one of said plurality of virtual circuits being provided on a second one of said plurality

5 of physical paths.

1 4. The method of claim 2, further comprising selecting one of said plurality of virtual circuits
2 for transmitting each of said subset of layer-3 datagrams, wherein said encapsulating is performed after
3 said selecting.

1 5. The method of claim 4, wherein said determining comprises retrieving a route entry from a
2 forwarding table using said destination address of a first IP datagram, wherein said route entry indicates
3 whether said IP route is to be used to transport said first IP datagram, and wherein said selecting is
4 performed based on said route entry.

1 6. The method of claim 5, wherein said determining is implemented in the form of a process
2 under the control of a scheduler, wherein said process and said scheduler are implemented substantially
3 in the form of software in said first edge router.

1 7. The method of claim 4, wherein said determining and selecting are implemented using a data
2 structure, which when traversed using said destination address returns a layer-2 header corresponding
3 to a virtual circuit on which a corresponding IP datagram is to be sent.

1 8. The method of claim 7, wherein said determining and said selecting are implemented in an
2 interrupt handler and wherein said data structure comprises a tree..

1 9. The method of claim 2, wherein layer-3 comprises Internet Protocol (IP) such that layer-3

2 datagrams, layer-3 protocol, and layer-3 route respectively comprise IP datagrams, IP protocol, and
3 IP route, and wherein said layer-2 comprises asynchronous transfer mode (ATM) such that said layer-2
4 packets comprise ATM cells.

1 10. A computer readable medium carrying one or more sequences of instructions for causing
2 a first edge router to process a plurality of layer-3 datagrams in a first edge router, said first edge router
3 being connected to a second edge router by a layer-2 network, wherein execution of said one or more
4 sequences of instructions by one or more processors contained in said first edge router causes said one
or more processors to perform the action of:

5 provisioning in said first edge router a plurality of virtual circuits on said layer-2 network, said
6 plurality of virtual circuits being associated with a layer-3 route;

7 receiving in said first edge router said plurality of layer-3 datagrams;

8 determining in said first edge router a subset of layer-3 datagrams, with each datagram having
9 a corresponding layer-3 route equal to said layer-3 route, wherein said subset of layer-3 datagrams are
10 comprised in said plurality of layer-3 datagrams;

11 encapsulating each of said subset of layer-3 datagrams in a corresponding plurality of layer-2
12 packets, some of said subset of layer-3 datagrams being encapsulated for sending on a first one of said
13 plurality of virtual circuits and some other of said subset of layer-3 datagrams being encapsulated for
14 transmission on another one of said plurality of virtual circuits; and

15 sending said plurality of layer-2 packets related to said subset of layer-3 datagrams on said
16 layer-2 network according to said encapsulating.
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1 11. The computer readable medium of claim 10, wherein said determining comprises using a

2 destination address comprised in each of said layer-3 datagrams to determine said corresponding layer-
3 3 route.

1 12. The computer readable medium of claim 11, wherein said layer-2 network comprises a
2 plurality of switches providing a plurality of physical paths between said first edge router and said
3 second edge router, said first one of said plurality of virtual circuits being provided on a first one of said
4 plurality of physical paths and said second one of said plurality of virtual circuits being provided on a
5 second one of said plurality of physical paths.

1 13. The computer readable medium of claim 11, further comprising selecting one of said
2 plurality of virtual circuits for transmitting each of said subset of layer-3 datagrams, wherein said
3 encapsulating is performed after said selecting.

1 14. The computer readable medium of claim 13, wherein said determining comprises retrieving
2 a route entry from a forwarding table using said destination address of a first IP datagram, wherein said
3 route entry indicates whether said IP route is to be used to transport said first IP datagram, and wherein
4 said selecting is performed based on said route entry.

1 15. The computer readable medium of claim 14, wherein said determining is implemented in
2 the form of a process under the control of a scheduler, wherein said process and said scheduler are
3 implemented substantially in the form of software in said first edge router.

1 16. The computer readable medium of claim 13, wherein said determining and selecting are

implemented using a data structure, which when traversed using said destination address returns a layer-2 header corresponding to a virtual circuit on which a corresponding IP datagram is to be sent.

17. The computer readable medium of claim 16, wherein said determining and said selecting are implemented in an interrupt handler and wherein said data structure comprises a tree.

18. A first edge router for processing a plurality of layer-3 datagrams, said first edge router being connected to a second edge router by a layer-2 network, said first edge router comprising:

means for provisioning a plurality of virtual circuits on said layer-2 network, said plurality of virtual circuits being associated with a layer-3 route;

means for receiving in said first edge router said plurality of layer-3 datagrams;

means for determining in said first edge router a subset of layer-3 datagrams, with each datagram having a corresponding layer-3 route equal to said layer-3 route, wherein said subset of layer-3 datagrams are comprised in said plurality of layer-3 datagrams;

means for encapsulating each of said subset of layer-3 datagrams in a corresponding plurality of layer-2 packets, some of said subset of layer-3 datagrams being encapsulated for sending on a first one of said plurality of virtual circuits and some other of said subset of layer-3 datagrams being encapsulated for transmission on another one of said plurality of virtual circuits; and

means for sending said plurality of layer-2 packets related to said subset of layer-3 datagrams on said layer-2 network according to said encapsulating.

19. The first edge router of claim 18, wherein said means for determining uses a destination address comprised in each of said layer-3 datagrams to determine said corresponding layer-3 route.

1 20. The first edge router of claim 19, further comprising means for selecting one of said
2 plurality of virtual circuits for transmitting each of said subset of layer-3 datagrams.

1 21. The first edge router of claim 20, wherein said means for determining retrieves a route entry
2 from a forwarding table using said destination address of a first IP datagram, wherein said route entry
3 indicates whether said IP route is to be used to transport said first IP datagram, and wherein said
4 selecting is performed based on said route entry.

1 22. The first edge router of claim 20, wherein said means for determining and said means for
2 selecting are implemented using a data structure, which when traversed using said destination address
3 returns a layer-2 header corresponding to a virtual circuit on which a corresponding IP datagram is to
4 be sent.

1 23. A first edge router for processing a plurality of layer-3 datagrams, said first edge router
2 being connected to a second edge router by a layer-2 network, said first edge router comprising:
3 a memory storing data indicating that a plurality of virtual circuits are provisioned to said second
4 edge router on said layer-2 network, said data further indicating that said plurality of virtual circuits are
5 associated with a layer-3 route;
6 an inbound interface receiving said plurality of layer-3 datagrams, wherein a subset of layer-3
7 datagrams comprised in said plurality of layer-3 datagrams are to be transmitted on said layer-3 route;
8 a virtual circuit (VC) determination block determining to send some of said subset of layer-3
9 datagrams on a first one of said plurality of virtual circuits and some other of said subset of layer-3

10 datagrams on another one of said plurality of virtual circuits; and
11 an outbound interface sending each of said subset of layer-3 datagrams on a determined one
12 of said plurality of virtual circuits in the form of a plurality of layer-2 packets on said layer-2 network.

1 24. The first edge router of claim 23, further comprising:
2 a segmentation block segmenting each of said subset of layer-3 datagrams into a plurality of
3 payloads; and
4 an encapsulator encapsulating said plurality of payloads in a corresponding plurality of layer-2
5 packets, wherein said plurality of layer-2 packets corresponding to each layer-3 datagram are
6 encapsulated according to the determination of said VC determination block;
7 wherein said determining comprises using a destination address comprised in each of said layer-3
8 datagrams to determine said corresponding layer-3 route.

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11 25. The first edge router of claim 24, wherein said layer-2 network comprises a plurality of
12 switches providing a plurality of physical paths between said first edge router and said second edge
1 router, said first one of said plurality of virtual circuits being provided on a first one of said plurality of
2 physical paths and said second one of said plurality of virtual circuits being provided on a second one
3 of said plurality of physical paths.
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1 26. The first edge router of claim 24, further comprising:
2 a forwarding table containing a plurality of route entries; and
3 a forwarding block retrieving a route entry from said forwarding table using said destination
4 address of a first IP datagram, wherein said route entry indicates whether said IP route is to be used

5 to transport said first IP datagram, and wherein said VC determination block selects either said first one
6 of said plurality of virtual circuits or said another one of said plurality of virtual circuits based on said
7 route entry.

1 27. The first edge router of claim 24, further comprising a data structure, which when traversed
2 using said destination address returns a layer-2 header corresponding to a virtual circuit on which a
3 corresponding IP datagram is to be sent.

1 28. The first edge router of claim 2, wherein layer-3 comprises Internet Protocol (IP) such that
2 layer-3 datagrams, layer-3 protocol, and layer-3 route respectively comprise IP datagrams, IP
3 protocol, and IP route.

1 29. The first edge router of claim 28, wherein each of said plurality of virtual circuits comprises
2 a permanent virtual circuit (PVC).

1 30. The first edge router of claim 29, wherein datagrams related to the same flow are
2 transmitted on the same virtual circuit such that an end system need not re-sequence the data in the
3 received datagrams.